30/Appeal Brief
10/6/03

MS APPEAL BRIEF
PATENT
1560-0345P

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re application of		Before the Board of Appeals	
Osamu SANO:			
Appl. No.:	09/582,870	Group:	3611
Filed:	July 6, 2000	Examiner:	DePumpo
Conf.:	4434		
For:	HYDRAULIC CONTROL VALVE AND POWER STEERING APPARATUS USING THE SAME		

APPEAL BRIEF TRANSMITTAL FORM

MS APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

September 24, 2003

Sir:
Transmitted herewith is an Appeal Brief (in triplicate) on behalf of the Appellants in connection with the above-identified application.

☐ The enclosed document is being transmitted via the Certificate of Mailing provisions of 37 C.F.R. § 1.8.

A Notice of Appeal was filed on July 25,2003.

☐ Applicant claims small entity status in accordance with 37 C.F.R. § 1.27

The fee has been calculated as shown below:

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☒ Fee for filing an Appeal Brief - $320.00 (large entity).

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If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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MRC/CJB:cb
1560-0345P

Attachment(s)

Docket No. 1560-0345P Application No. 09/582,870

PATENT

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For: HYDRAULIC CONTROL VALVE AND POWER STEERING APPARATUS USING THE SAME

BRIEF FOR APPELLANT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

September 24, 2003

Sir:

This appeal is from the decision of the Examiner dated May 22, 2003, finally rejecting claims 29, 30, 34-39 and 74-84, which are reproduced as an Appendix to this Brief. This Brief if being filed in triplicate with the requisite fee.

The commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17 and 1.21 that may be required by this paper, and to credit any overpayment, to deposit account 02-2448.

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I. Real Party in Interest

The named inventors have assigned their rights to the invention that is disclosed in the application and any patent that may issue therefrom to Koyo Seiko Co., LTD., as recorded in the Patent and Trademark Office at Reel 010981, Frame 0836.

II. Related Appeals and Interferences

To the best of the knowledge of the undersigned, there are no other appeals or interferences known to the Appellants, the Appellants' representatives, or the above noted assignee that will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. Status of the Claims

Claims 29-39, 41-43, 56-58 and 74-84 are currently pending in the application. Claims 31-33, 41-43 and 56-58 have been withdrawn from consideration. Claims 29, 30, 34-39 and 74-84 are rejected and the subject of the appeal. Claims 29 and 39 are the independent claims.

IV. Status of Amendments

There were no amendments filed subsequent to the final rejection.

V. Summary of the Invention

In conventional hydraulic power steering apparatus, a hydraulic control valve is utilized to control the supply and discharge of oil pressure in accordance with the direction and magnitude of a steering torque applied to the steering wheel. The steering wheel is connected to an input shaft. Located at the end of the input shaft is one of a valve body or valve spool. An output shaft that is connected to a steering mechanism, also has attached to it one of a valve body or valve spool (the opposite of what is connected to the input shaft). The valve spool is coaxially and rotatably fitted to the valve body. When a torque is applied on the steering wheel, a torsion bar coaxially connecting the input and output shafts is twisted. A relative angular displacement is generated based on this twisting between the valve spool and valve body controlling the steering based on the controlled flow of oil through the valve.

The design of the valve body and valve spool has a dramatic impact on how the valve will operate. For example pressure differences at various points between the valve body and valve spool can be increased or decreased at different states of torque on the valve based on their design. One of these changes involves the use of chamfered corners on the lands (teeth like projections formed on the valve spool and valve body). Various designs of valve

spool lands and valve body lands have been created for specific applications. These designs include the angle of the chamfered corner, the number of chamfered corners and specific arrangements of the chamfered corners. The use of various valve body and valve spool designs can dramatically change the operational characteristics of the hydraulic device and, thereby, the operation of the power steering apparatus.

The present invention relates to a hydraulic control valve in which only the lands associated with first oil grooves 4 and the second oil grooves 5 on a valve spool 2 and facing throttle portions 6a, 6b between the oil supply chambers 10 and oil feed chambers 12, 13 are provided with chamfers as illustrated in Figs. 8A & 8B. Fig. 8B is reproduced below for the Board's convenience. Appellant notes that the features of Fig. 8A is structurally equivalent to Fig. 8B.

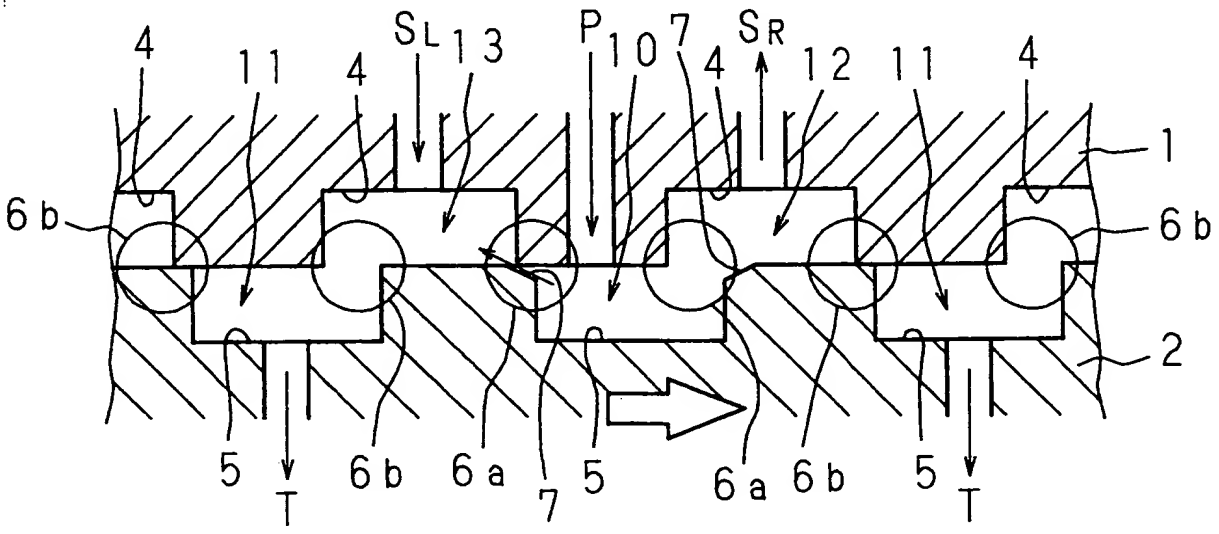

FIG. 8B

The present invention also provides chamfer portions 7 provided on valve body 1 facing the throttle portions 6a, 6b between an oil discharge chamber and the oil feed chambers 12, 13, as illustrated in Figs. 12A & 12B. Fig. 12B is reproduced below for the Board's convenience. Appellant notes that the features of Fig. 12A is structurally equivalent to Fig. 12B.

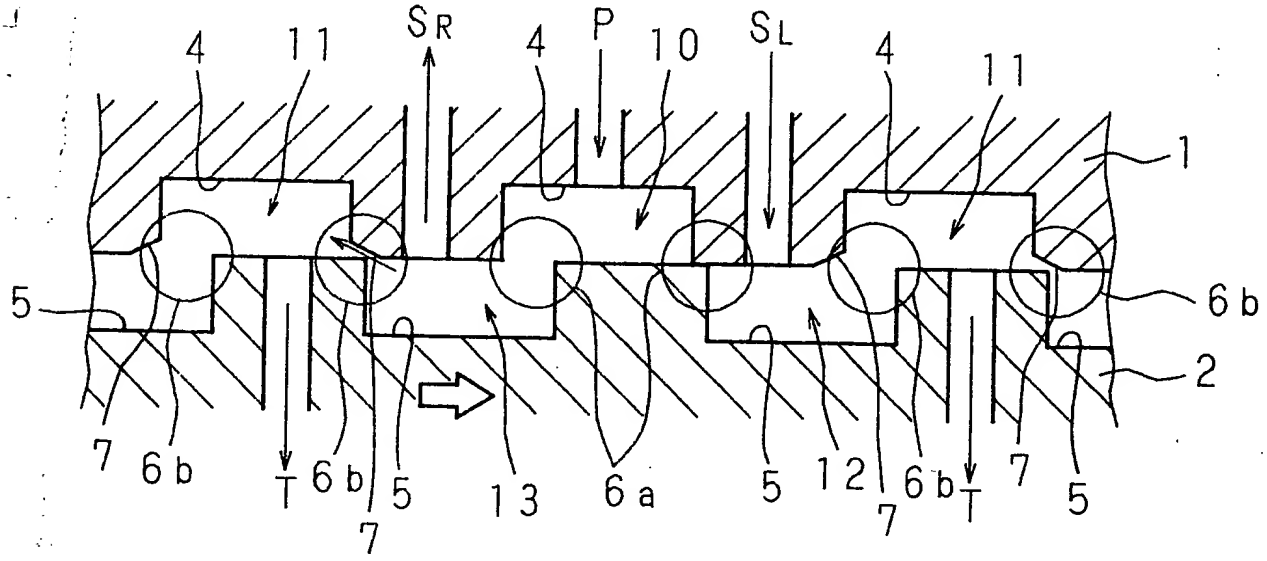

FIG. 12B

In each of the above noted figures, the chamfer portions 7 are formed on the corners of the lands. See page 13, lines 6-20 and Fig. 7. Each of the valve body lands and also the valve spool lands are provided in pairs. The pair is defined by only one corner on each of the valve body lands or valve spool lands in the pair being chamfered, so that the chamfered corners 7 of adjacent lands are directly across from one another. This reduces the number of portions

where the flow rate is to be controlled. See page 17, lines 1-25 to page 18, line 1.

Further, providing the unique arrangement of the present invention allows the flow rate, which is to be distributed to each of the portions where the flow rate is to be controlled, to be dramatically increased in relation to systems of the prior art. This stabilizes the hydraulic characteristics in a region where the flow rate to be controlled is minimum and eliminates discontinuity in the hydraulic characteristics. See page 15, lines 8-24. Thus, the flow rate of the hydraulic pump can be increased on the basis of a steering angular velocity of the steering wheel (when a steering operation is carried out), and the controlled flow rate of the hydraulic control valve can be abruptly and efficiently increased from a very small flow rate, such as during idling, to a high flow rate, such as during a steering operation.

VI. The Issues

The final Office Action presents two issues for review on Appeal.

1. Whether claims 29, 30 and 34-38 are unpatentable under 35 U.S.C § 103(a) over Yuuichi (JP 8104246) in view of U.S. Patent No. 5,645,107 to Kobayashi et al.
2. Whether claims 39 and 74-84 are unpatentable under 35 U.S.C. § 103(a) over the combination of Yuuichi (JP 8104246) and U.S. Patent No. 5,645,107 to Kobayashi et

al. in further view of Applicant's Admitted Prior Art (AAPA).

VII. Grouping of the Claims

For purpose of this appeal, Appellants do not consider the claims to stand or fall together. Rather, the claims are grouped as follows:

- Claims 29 and 30, 34-38 stand or fall together
- Claims 39, 74-79 and 80-84 stand or fall together

VIII. Argument

I. CLAIMS 29, 30 AND 34-38 ARE NOT UNPATENTABLE UNDER 35 U.S.C § 103(A) OVER YUUICHI (JP 8104246) IN VIEW OF U.S. PATENT NO. 5,645,107 TO KOBAYASHI ET AL.

To establish *prima facie* obviousness, all claim limitations must be taught or suggested by the prior art and the asserted modification or combination of prior art must be supported by some teaching, suggestion, or motivation in the applied reference or in knowledge generally available to one skilled in the art. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). Thus, "[a]ll words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). The prior art must suggest the desirability of the modification in order to establish a

prima facie case of obviousness. *In re Brouwer*, 77 F.3d 422, 425, 37 USPQ2d 1663, 1666 (Fed. Cir. 1995). It can also be said that the prior art must collectively suggest or point to the claimed invention to support a finding of obviousness. *In re Hedges*, 783 F.2d 1038, 1041, 228 USPQ 685, 687 (Fed. Cir. 1986); *In re Ehrreich*, 590 F.2d 902, 908-09, 200 USPQ 504, 510 (CCPA 1979).

A. The References Fail to Teach all the Claimed Limitations

Claim 29 recites, *inter alia*, a valve spool, fitted into said valve body so as to be changeable in relative angle, said valve spool including a plurality of valve spool lands; wherein only one of said valve body and valve spool includes pairs of chamfers which are so formed that each of ones of the valve body lands and the valve spool lands has only one chamfer.

The language of independent claim 29 clearly states that only one of said valve body and valve spool has included thereon a pair of chamfers. The pair of chamfers, as discussed in the summary, are uniquely arranged so that each of the valve spool lands or the valve body lands only has one corner which is chamfered. The location of the single chamfered corner on each of the valve body or valve spool lands is such that the chamfered corners of adjacent lands are on located on opposite corners of the lands. Thus, the chamfers on adjacent lands appear to be facing each other, and thereby forms a pair of

chamfers. Figs. 8A and 8B provide and exemplary illustration of the features recited in claim 29. As illustrated in the figures, the valve body lands do not have chamfers while the valve spool lands contain only one chamfer on each of the lands. The chamfers on the valve spool lands are arranged to form a pair of chamfers, as seen by the chamfers being located on the valve spool lands forming opposite sides of a second oil groove.

The Examiner fails to make out a *prima facie* case of obviousness for claim 29 because Yuuichi and Kobayashi do not disclose or suggest the combination of features defined in claim 29 indicated above. As is detailed below the teachings of Yuuichi and Kobayashi each teach unique hydraulic valve systems each having valve body and valve spool arrangements contrary to the features recited in claim 29.

As easily seen in the figures of Yuuichi, the hydraulic system disclosed therein provides chamfers on both the valve body lands and valve spool lands. The chamfer arrangement illustrated in Fig. 8 of Yuuichi (reproduced below) provides only one chamfer on each of the valve spool lands, but also provides a chamfer on alternating ones of the valve body lands. This can be seen in the below illustration of Figure 8 of Yuuichi.

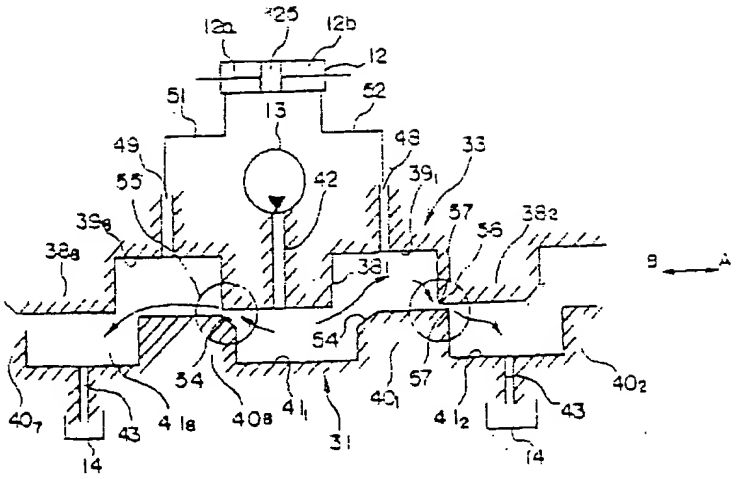

Figure 8 of Yuuichi

Kobayashi, on the other hand, provides a hydraulic system in which chamfers are provided on only the valve spool lands or on only the valve body lands in which chamfers are provided on both corners of each of the valve body lands or valve spool lands. These two embodiments of Kobayashi are illustrated in Figs. 8A & 8B and 14A & 14B, respectively. Further, Kobayashi's system provides two chamfers on each of the valve spool lands or valve body lands, one on each corner of the lands. This can be seen in the below illustration of Fig. 8A and Fig. 14A.

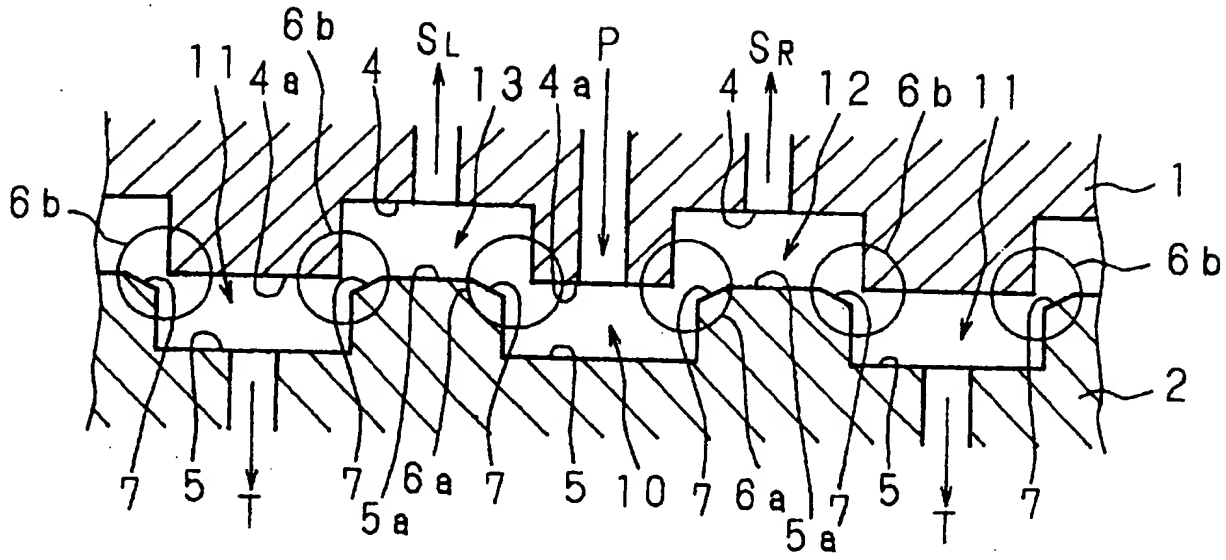

Fig. 8A of Kobayashi

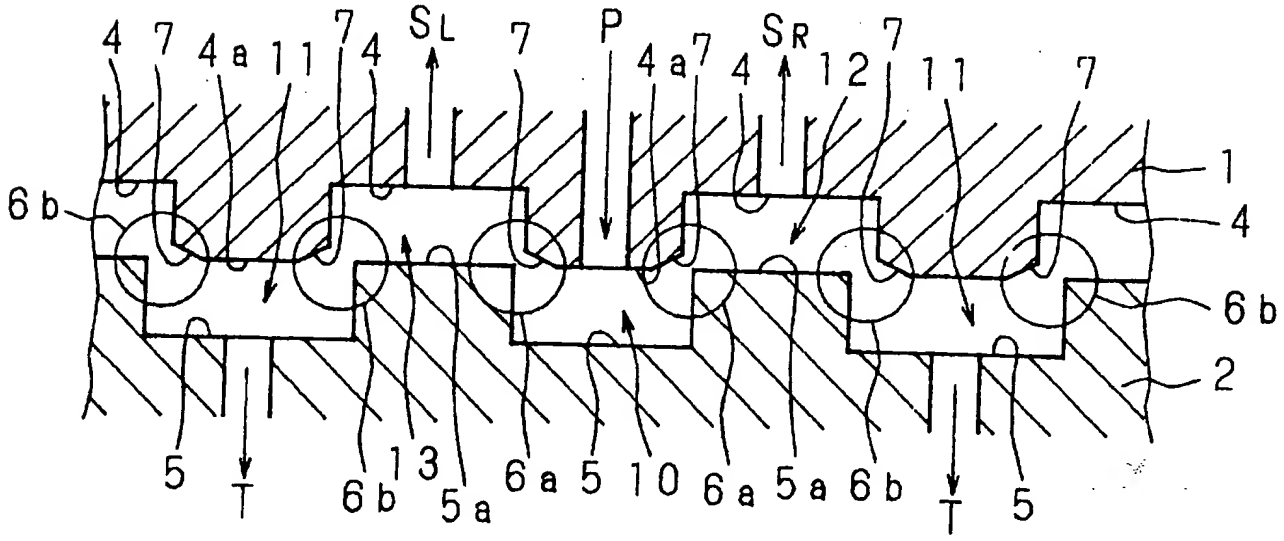

Fig. 14A of Kobayashi

Neither of these references teach the unique features recited in claim 29 of providing a chamfer arrangement which includes a pair of chamfers on only one of said valve body lands or valve spool lands. As stated above, Appellant's

independent claim 29 recite, *inter alia*, "wherein only one of said valve body and said valve spool includes pairs of chamfers which are so formed that each of ones of the valve body lands and the valve spool lands has only one chamfer." Yuuichi teaches the use of chamfers on both the valve body land and valve spool land. The Examiner recognizes this deficiency in Yuuichi, as he states that Yuuichi in disclosing chamfers on the valve spool "also discloses chamfers on the valve body and therefore, the chamfers are not on 'only one of the valve body or the valve spool', as claimed".

The Examiner relies on Figs. 4A and 4B of Kobayashi to make up for Yuuchi's deficiencies. In view of these figures, the Examiner states that "Kobayashi discloses that it is not necessary to have chamfers on the valve body." It appears that the Examiner is alleging that because Kobayashi provides chamfers on only the valve spool, then Kobayashi suggests that it is not necessary to have chamfers on the valve body and thus the combination of Yuuichi and Kobayashi could be achieved. However, the Examiner has failed to recognize that the unique design of Kobayashi is necessary for performing the function for which it was designed. Suggesting that because Kobayashi does not provide chamfers on the valve body lands that the design of the system of Yuuichi could be changed so that the valve body lands also do not have chamfers is unfounded. Changing the system of Yuuichi in this manner would impact the operation characteristics of Yuuichi in an unknown manner.

Further, even if the Examiner's reasoning is viable, which appellant maintains it is not, if this reasoning is applied to Yuuichi, it would suggest that because Yuuichi provides chamfers on both the valve spool and valve post, then inherently Yuuichi is asserting that it is necessary to include chamfers on both the valve spool and valve posts. Thus, even under the Examiner's reasoning Kobayashi and Yuuichi would provide different teachings and could not be combined and therefore do not teach the claimed features.

B. No Motivation to Combine Teachings of References

The Examiner argues that the motivation to combine the teachings of Yuuichi and Kobayashi is mainly the "ease of manufacturing". This would imply that the changing of chamfers requires no undue experimentation or novelty and is merely routine experimentation. This is incorrect. As stated above, the hydraulic system of the present invention achieves an improved flow rate to the portions of the hydraulic system where the flow rate is controlled over the prior art. This allows for stabilization in regions where the flow rate is a minimum and eliminates discontinuity in the hydraulic characteristics. The description of Fig. 8 on pages 32 and 33 of the specification states:

> Fig. 8B shows a state in which the steering wheel is operated and the relative angular displacement is generated between the valve body 1 and the valve spool 2. On the other hand, when the relative angular displacement is generated between the valve body 1 and the valve spool 2 as

> the steering wheel (not shown) is operated, throttle areas of the throttle portions 6a, 6a, ... between the oil supply chamber 10 and the first and second oil chambers 12, 13 and throttle areas of the throttle portions 6b, 6b, ... between the oil discharge chamber 11 and the first and second oil chambers 12, 13 are changed.
>
> This change is generated in opposite directions from each other at both sides of the first and second oil chambers 12, 13. For example, the relative rotation of the valve spool 2 with respect to the valve body 1 is generated in the clockwise direction in Fig. 7, the valve spool 2 relatively moves in the direction shown with the hollow arrow in Fig. 8B. At that time, in the first oil feed chamber 12, the throttle area of the throttle portion 6a of the oil supply chamber 10 side is increased, and the throttle area of the throttle portion 6b of the oil discharge chamber 11 side is reduced without being controlled by the chamfer portion. On the other hand, in the second oil feed chamber 13, the throttle area of the throttle portion 6a of the oil supply chamber 10 side is controlled and reduced by the chamfer portion 7, and the throttle area of the throttle portion 6b of the oil discharge chamber 11 side is increased.

Thus, as discussed in the above section of the specification, chamfer arrangements significantly impact the controlling of the throttle areas and the oil feed and discharge chambers. Therefore, the hydraulic characteristics are significantly impacted by chamfer changes. Because of this significant impact, various experiments and innovations are necessary to achieve a specific result and solve the problems associated with the prior art. Specifically, stabilizing hydraulic characteristics in a region where the flow rate to be controlled is a minimum. One of ordinary skill in the art would not merely change the chamfer arrangements of Yuuichi and Kobayashi to ease manufacturing, as suggested by the Examiner, to obtain appellant's claimed invention.

Further, the Examiner cites column 4, line 6 of Kobayashi and states this section of Kobayashi "discloses that the chamfers are only necessary on the sections of the spool posts that are adjacent the pump supply to reduce noise". This section of Kobayashi does not disclose that it is only necessary to provide chamfers on the spool posts. This section of text discloses the use of two chamfers on every other spool post, which through experimentation has shown to reduce the occurrence of noise. Specifically, column 4, lines 6-13 states that the chamfer arrangement is:

> based on the discovery that noises due to cavitation occurs in the throttles 6 on both sides of the oil drain chambers 11 more often than in those on both sides of the oil supply chambers 10 under the structure in which the oil grooves 4 of the valve body 1 constitute the oil supply chambers 10 and the oil drain chambers 11, and the oil grooves 5 of the valve spool 2 constitute the oil transfer chambers 12 and 13.

Therefore, as detailed above, the chamfer arrangement is not made for ease of manufacturing or because it is unnecessary to include chamfers on the valve body lands, but is made because through experimentation a discovery was made based on the specific chamfer arrangements and system criteria that a reduction of noise occurred. Thus, this section 1) teaches a chamfer design different from appellant's claimed chamfer arrangement, 2) discloses that the chamfer design is specifically arranged to reduce noise, not ease of manufacturing and 3) the design was made through experimentation and discovery, which is contrary to the Examiner's assertions that the manipulation of chamfer arrangements is not novel.

Further, it is unclear to appellant how changing chamfer arrangements significantly eases the manufacturing process enough to motivate one of ordinary skill. The Examiner has provided no evidence to support his allegation. Appellant contends that chamfers are necessary features in the operation of the systems of Kobayashi and Yuuichi. Therefore, whimsically eliminating or adding chamfers for manufacturing purposes, as the Examiner suggest, would unlikely be considered. Furthermore, as stated above, a successful combination of the teachings of Yuuichi and Kobayashi is unlikely due to the fact that the system of Yuuichi and Kobayashi are each designed specifically to operate in a specific manner. Any changes made to the chamfers would change the manner in which the system operates.

Moreover, the prior art itself suggests the unlikeliness of combining the teachings of Yuuichi and Kobayashi. It is apparent from the teachings of the prior art, that various chamfer arrangements have been utilized in order to change the operational characteristics of the hydraulic device. Thus, it is known that slight modifications to the chamfers, how they are shaped and their arrangement, impacts the operation of the hydraulic device. Therefore, one of ordinary skill in the art would not simply transpose the arrangements of the valve body of one system with the valve spool of another system, as alleged by the Examiner. Appellant's respectfully submit that it is numerous experimentation and innovation that is used in determining the chamfer arrangements.

Thus, neither Kobayashi or Yuuichi provide any motivation to change the design of the valve spool and valve land configurations of their respective systems in a manner necessary to combine the teachings of Yuuichi and Kobayashi to achieve appellant's claimed invention, as alleged by the Examiner.

II. CLAIMS 39 AND 74-84 ARE NOT UNPATENTABLE UNDER 35 U.S.C. § 103(A) OVER THE COMBINATION OF YUUICHI (JP 8104246) AND U.S. PATENT NO. 5,645,107 TO KOBAYASHI ET AL. IN FURTHER VIEW OF APPLICANT'S ADMITTED PRIOR ART (AAPA)

Claim 39 recites the features of a valve body, including a plurality of valve body lands, and a valve spool, fitted into said valve body so as to be changeable in relative angle, said valve spool including a plurality of valve spool lands, wherein only one of said valve body and said valve spool includes pairs of chamfers which are so formed that each of ones of the valve body lands and the valve spool lands has only one chamfers. These features are the same as those discussed above in relation to claim 29. Therefore, at least for the reasons asserted with respect to claim 29, claim 39 is patentably distinguishable over the combination of Yuuichi and Kobayashi.

Claim 39 further recites features of a hydraulic pump being driven by an electric motor for supplying oil pressure to a hydraulic cylinder for steering assistance and a hydraulic control valve interposed in a pressure path between

said hydraulic pump and hydraulic cylinder for controlling oil pressure form said hydraulic pump to two cylinder chambers included in said hydraulic cylinder.

Yuuichi and Kobayashi each do not teach the combination of the above hydraulic pump, hydraulic cylinder and hydraulic control valve with the unique chamfer arrangement discussed above. Further, the Examiner makes reference to appellant's admitted prior art in combination with Yuuichi and Kobayashi to reject claim 39.

Appellants admitted prior art provides chamfer arrangements similar to those of Kobayashi, in which two chamfers are provided on every valve spool land. Appellants admitted prior art does not teach or suggest the combination of the hydraulic pump, hydraulic cylinder and control valve with the chamfer arrangements recited in claim 39. Applicant's admitted prior art discusses chamfer arrangements on all the valve spool lands and on each corner of each valve spool land. Applicant's admitted prior art does not teach or suggest a pair of chamfers are formed so that each of ones of the valve body lands and the valve spool lands has only one chamfer, as recited in claim 39. Thus, the combination of references still lack the necessary conditions for establishing a rejection under 35 U.S.C. 103, including teaching all the claim limitations and providing proper motivation as set forth above.

IX. Conclusion

Based on the reasons set forth above, the rejections of claims 29, 30, 34-39 and 74-84 under 35 U.S.C. §103 should be REVERSED. As shown in the foregoing arguments, the claimed features of the present invention are not disclosed or suggested in the cited documents. Further, one of ordinary skill in the art would not look to combine the teachings of the references. Accordingly, reversal of the rejection is respectfully requested.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. 1.16 or under 37 C.F.R. 1.17; particularly, extension of time fees.

Respectfully submitted,

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Appendix of Claims

Claim 29. A hydraulic control valve comprising:

a valve body, including a plurality of valve body lands; and

a valve spool, fitted into said valve body so as to be changeable in relative angle, said valve spool including a plurality of valve spool lands;

wherein only one of said valve body and said valve spool includes pairs of chamfers which are so formed that each of ones of the valve body lands and the valve spool lands has only one chamfer.

Claim 30. The hydraulic control valve according to claim 29, wherein the pairs of chamfers are comprised of adjacent valve spool lands, each having a single chamfer provided on an alternate corner from each adjacent valve spool land.

Claim 34. The hydraulic control valve according to claim 29, wherein said valve body includes a plurality of first oil grooves formed between said valve body lands.

Claim 35. The hydraulic control valve according to claim 34, wherein said valve spool includes a plurality of second oil grooves formed between said valve spool lands.

Claim 36. The hydraulic control valve according to claim 35, wherein gaps between said first and second oil grooves, which are adjacent in the peripheral direction act as throttle portions which change throttle areas in accordance with a relative angular displacement between said valve body and valve spool.

Claim 37. The hydraulic control valve according to claim 35, wherein ones of said first and second oil grooves alternately act as oil supply chambers and oil discharge chambers, and the others of said first and second oil grooves acting as oil feed chambers interposed between said oil supply chambers and oil discharge chambers.

Claim 38. The hydraulic control valve according to claim 29, wherein chamfers adjust a throttle area.

Claim 39. A power steering apparatus, comprising:

a hydraulic pump, being driven by an electric motor for supplying oil pressure to a hydraulic cylinder for steering assistance; and

a hydraulic control valve; interposed in a hydraulic pressure path between said hydraulic pump and hydraulic cylinder, for controlling oil pressure from said hydraulic pump to two cylinder chambers included in said hydraulic cylinder, said hydraulic control valve comprising:

a valve body, including a plurality of valve body lands; and a valve spool, fitted into said valve body so as to be changeable in relative angle, said valve spool including a plurality of valve spool lands;

wherein only one of said valve body and said valve spool includes pairs of chamfers which are so formed that each of ones of the valve body lands and the valve spool lands has only one chamfer.

Claim 74.

The power steering apparatus according to claim 39, wherein the pairs of chamfers are comprised of adjacent valve spool lands, each having a single chamfer provided on an alternate corner from each adjacent valve spool land.

Claim 75. The power steering apparatus according to claim 39, wherein said hydraulic pump is driven such that a flow rate becomes low flow rate or zero flow rate when steering is not carried out, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out, and

said valve body includes a plurality of first oil grooves formed between said valve body lands.

Claim 76. The power steering apparatus according to claim 75, wherein said valve spool includes a plurality of second oil grooves formed between said valve spool lands.

Claim 77. The power steering apparatus according to claim 76, wherein gaps between said first and second oil grooves, which are adjacent in the peripheral direction act as throttle portions which change throttle areas in accordance with a relative angular displacement between said valve body and valve spool.

Claim 78. The power steering apparatus according to claim 76, wherein ones of said first and second oil grooves alternately act as oil supply chambers and oil discharge chambers, and the others of said first and second oil grooves acting as oil feed chambers interposed between said oil supply chambers and oil discharge chambers.

Claim 79. The power steering apparatus according to claim 39, wherein said hydraulic pump is driven such that a flow rate becomes a low flow rate or zero flow rate when steering is not carried out, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out, and chamfers adjust throttle area.

Claim 80. The power steering apparatus according to claim 39, wherein said electric motor drives said hydraulic pump such that oil pressure is supplied at zero flow rate or predetermined small flow rate as small as possible when steering is not carried out, and such that the oil pressure is abruptly supplied at high flow rate in accordance with the steering angular velocity at the steering is carried out, and

said valve body includes a plurality of first oil grooves formed between said valve body lands.

Claim 81. The power steering apparatus according to claim 80, wherein said valve spool includes a plurality of second oil grooves formed between said valve spool lands.

Claim 82. The power steering apparatus according to claim 81, wherein gaps between said first and second oil grooves, which are adjacent in the peripheral direction act as throttle portions which change throttle areas in accordance with a relative angular displacement between said valve body and valve spool.

Claim 83. The power steering apparatus according to claim 81, wherein ones of said first and second oil grooves alternately act as oil supply chambers and oil discharge chambers, and the others of said first and second oil grooves acting as oil feed chambers interposed between said oil supply chambers and oil discharge chambers.

Claim 84. The power steering apparatus according to claim 39, wherein said electric motor drives said hydraulic pump such that oil pressure is supplied at zero flow rate or predetermined small flow rate as small as possible when steering is not carried out, and such that the oil pressure is abruptly supplied at high flow rate in accordance with the steering angular velocity at the steering is carried out, and chamfers adjust throttle area.